CLAIMS

What is claimed as new and desired to be protected by Letters Patent of the United States is:

1. A microelectronic package comprising:

   (a) a microelectronic element having front and rear sides,

   (b) a front cover overlying the front side of said element, said front cover being spaced from said front side so as to define a front space between said front side and front cover;

   (c) a rear cover overlying the rear side of said element, said rear cover being spaced from said rear side so as to define a rear space between said rear side and said rear cover; and

   (d) one or more seals surrounding at least a portion of said element connecting said covers to said element, to one another or both.

2. A package as claimed in claim 1 further comprising electrically conductive connections extending from a

portion of said element surrounded by said seals through at least one of said covers.

3. A package as claimed in claim 1 wherein said element includes a central portion and a peripheral portion surrounding said central portion, said seals including a front seal extending between said peripheral portion of said element and said front cover.

4. A package as claimed in claim 3 wherein said seals include a rear seal extending between said peripheral portion of said element and said rear cover.

5. A package as claimed in claim 4 wherein said element and said covers have substantially equal dimensions in horizontal directions parallel to said front surface.

6. A package as claimed in claim 1 wherein said seals include a loop seal extending between said covers so that said loop seal and said covers cooperatively define a sealed chamber including said front and rear spaces, said element being disposed within said chamber.

7. A package as claimed in claim 6 wherein said element does not contact said loop seal.

8. A package as claimed in claim 6 further comprising spacers mechanically supporting said element out of contact with said front and rear covers.

9. A package as claimed in claim 6 further comprising internal electrical connections extending between said element and at least one of said covers.

10. A package as claimed in claim 9 wherein said at least one of said covers includes a circuit element, said internal electrical connections electrically connecting said element to said circuit element.

11. A package as claimed in claim 10 further comprising electrically conductive connections extending from one of said covers which includes said circuit element through the other one of said covers.

12. A package as claimed in claim 1 wherein said element includes a detector sensitive to radiation and at least one of said covers is transparent to said radiant energy.

13. A package as claimed in claim 12 wherein said element includes an emitter adapted to emit radiant energy.

14. A sensing unit comprising a package as claimed in claim 13 and a reflector fixed to said package but spaced from said package so as to define an analyte space between said package and said reflector, said reflector and said package being constructed and arranged so that light emitted by said emitter will pass through one of said covers, through said analyte space to said reflector, from said reflector through said analyte space and through one of said covers to said detector.

15. A sensing unit as claimed in claim 14 wherein said emitter is arranged to direct radiation forwardly through said front cover, said detector is arranged to detect radiation passing rearwardly through said front cover, and said reflector

overlies said front cover so that said analyte space is disposed between said reflector and said front cover.

16. A sensor including:

(a) a microelectronic element having front and rear surfaces, said microelectronic element including an emitter adapted to emit radiation in a selected wavelength band forwardly from said front surface and a detector adapted to detect radiation in said band directed rearwardly to said front surface;

(b) a front cover overlying said front surface, said front cover having a window portion aligned with said emitter and detector, at least said window portion being substantially transparent to radiation in said band;

(c) a seal encircling said emitter and detector and extending rearwardly from said front cover; and

(d) one or more electrical connectors extending through said front cover, said electrical connectors being electrically connected to said microelectronic element.

17. A sensor as claimed in claim 16 wherein said microelectronic element includes a unitary substrate, said

emitter and detector being disposed on said unitary substrate.

18. A sensor as claimed in claim 17 wherein said emitter and detector include semiconductor elements epitaxially grown on said substrate.

19. A sensor as claimed in claim 17 wherein said substrate consists essentially of silicon.

20. A sensor as claimed in claim 16 wherein said seal extends from said front cover to said microelectronic element.

21. A sensor as claimed in claim 20 wherein at least said window portion of said front cover is spaced from said microelectronic element so that said front cover and said element define a front space therebetween.

22. A sensor as claimed in claim 21 further comprising a thermal insulator overlying said rear surface of said element.

23. A sensor as claimed in claim 22 wherein said thermal insulator includes a rear cover overlying said rear surface of

said element, at least a portion of said rear cover being spaced apart from said element so that said rear cover and said element define a rear space between said rear cover and said element.

24. A sensor as claimed in claim 16 wherein at least some of said electrical connectors extend from said element through said front cover.

25. A sensor as claimed in claim 16 further comprising a reflector overlying said front cover and spaced from said front cover so that said reflector and said front cover define an analyte space therebetween, said reflector being operative to reflect energy emitted by said emitter through said front cover and said analyte space back through said analyte space to said detector.

26. A sensor as claimed in claim 25 wherein said reflector includes electrically conductive elements connected to said electrical connectors.

27. A sensor as claimed in claim 26 wherein said reflector has a proximal surface facing toward said front cover and a distal

surface facing away from said front cover, said electrically conductive elements including terminals exposed at said distal surface.

28. A sensor as claimed in claim 26 wherein said reflector is a circuit panel extending outwardly beyond said unit and said front cover in one or more horizontal directions, said circuit panel including electrically conductive traces connected to said electrical connectors.

29. A sensor comprising:

(a) a reflector having a proximal surface and electrically conductive features, at least a portion of said proximal surface being adapted to reflect radiation in a predetermined wavelength band;

(b) a microelectronic element including an emitter and a detector mounted to said reflector so that there is an analyte space between said microelectronic element and said proximal surface of said reflector, said emitter being arranged to direct radiation in said band through said analyte space to said reflector so that said radiation will be reflected by said reflector back through said analyte space

to said detector, said microelectronic element being electrically connected to said electrically conductive features of said reflector.

30. A sensor as claimed in claim 29 wherein said reflector has a distal surface facing away from said microelectronic element and said electrically conductive features include terminals exposed at said distal surface.

31. A sensor as claimed in claim 30 wherein said reflector has horizontal dimensions substantially equal to or less than the horizontal dimensions of said microelectronic element.

32. A sensor as claimed in claim 29 wherein said reflector is a circuit panel extending outwardly beyond said microelectronic element in at least one horizontal direction, and wherein said electrically conductive features include traces on said circuit panel.

33. A method of making a microelectronic package comprising the steps of:

(a) assembling a front cover plate to a front side of a main wafer so that said front cover plate is spaced from

said front side of said main wafer;

(b) providing front spacing elements extending between said front cover plate and said main wafer;

(c) assembling a rear cover plate to a rear side of said main wafer so that rear cover plate is spaced from said rear side of said main wafer;

(d) providing rear spacing elements extending between said rear side of said main wafer and said rear cover plate; and

(e) after said assembling and providing steps, severing said plates and wafer to form a plurality of units, each including a region of said main wafer, regions of said front and rear plates, and front and rear spacing elements connecting said regions of said plates to said region of said main wafer.

34. A method as claimed in claim 33 wherein said step of providing front spacing elements includes providing front seals, each such seal enclosing a region of said front side.

35. A method as claimed in claim 34 wherein said step of providing rear spacing elements includes providing rear

seals in alignment with said front seals, each said rear seal enclosing a region of said rear surface.

36. A method as claimed in claim 35 wherein said severing step includes severing said wafer and said plates along said front and rear seals.

37. A method as claimed in claim 34 further comprising forming (i) electrical connections extending from the regions of said front surface enclosed by said front seals through said front plate prior to said severing step; and (ii) sealing said front plate at locations where said electrical connections pass through said front plate.

38. A method of as claimed in claim 34 further comprising providing a reflector plate overlying a surface of said front plate and reflector spacing elements extending between said reflector plate and said front plate prior to said severing step, said reflector spacing elements being spaced apart from one another so as to define gaps therebetween, said severing step including severing said reflector plate so that each said unit includes a portion of said reflector plate.

39. A method of making a plurality of sensors including:

(a) providing a wafer-level assembly including a main wafer having a plurality of regions, each of said regions including an emitter operative to emit light and a detector operative to detect light and a front plate at least partially transparent to said light;

(b) attaching a reflector plate to said front plate so that said reflector plate is spaced apart from said front plate and reflector spacing elements extend between said front plate and said reflector plate at spaced-apart locations; and

(c) after said providing and attaching steps, severing said assembly and said reflector plate to provide a plurality of individual units, each including a region of said main wafer, a portion of said front plate forming a front cover, a portion of said reflector plate forming a reflector, an analyte space between the reflector front cover, and a plurality of said reflector spacing elements, such analyte space being open to the exterior of the unit through spaces between the reflector spacing elements.

40. A method as claimed in claim 39 wherein at least some of said reflector spacing elements are electrically conductive, the method further including the step of electrically connecting the conductive reflector spacing elements to regions of said main wafer.

41. A sensor including:

(a) a semiconductor chip including an emitter adapted to emit radiant energy in a wavelength band in a forward direction and a detector adapted to detect radiant energy in said wavelength band; and

(b) a reflector fixed to said chip forward of said emitter and detector so that radiant energy emitted by said emitter will be reflected to said detector, and

(c) a structure defining an analyte space open for passage of an analyte therethrough, said analyte space being disposed between said chip and said reflector, whereby radiant energy passing to and from said reflector will pass through analyte in said space.

42. A sensor including:

(a) a semiconductor chip including an emitter adapted

to emit radiant energy in a wavelength band in a forward direction and a detector adapted to detect radiant energy in said wavelength band; and

(b) a reflector fixed to said chip forward of said emitter and detector so that radiant energy emitted by said emitter will be reflected to said detector, said reflector being exposed to an environmental condition in the vicinity of said sensor and having reflectivity which varies in response to said environmental condition.